Bio-Imaging Research, Inc.

Waste Inspection Tomography (WIT)

Technology Need:

The Department of Energy (DOE) has in excess of 600,000 nuclear waste drums currently stored at more than thirty sites within the United States that need to be characterized over the next few years. The contents of these drums must be characterized and designated as high-level waste (HLW), low-level waste (LLW), or transuranic waste (TRU), before the drums are assigned to a permanent storage location. Many of the drums contain dense materials, such as sludge or cement, making them difficult to characterize by non-invasive technologies.

Technology Description:

Bio-Imaging Research, Inc. (BIR) has developed a mobile waste inspection tomography (WIT) system that can be brought to the waste site to perform tomographic characterization of nuclear waste drums using a multimodality approach. WIT integrates high-energy computed tomography (CT), emission tomography (ECT) and emission spectroscopy for noninvasive x-ray examination and gamma assay. WIT will safely and cost-effectively identify contents, provide two- and three-dimensional information about contents, locate isotope emissions, identify the emitting isotope, and quantify the mass of the isotopes. WIT utilizes the following inspection technologies:

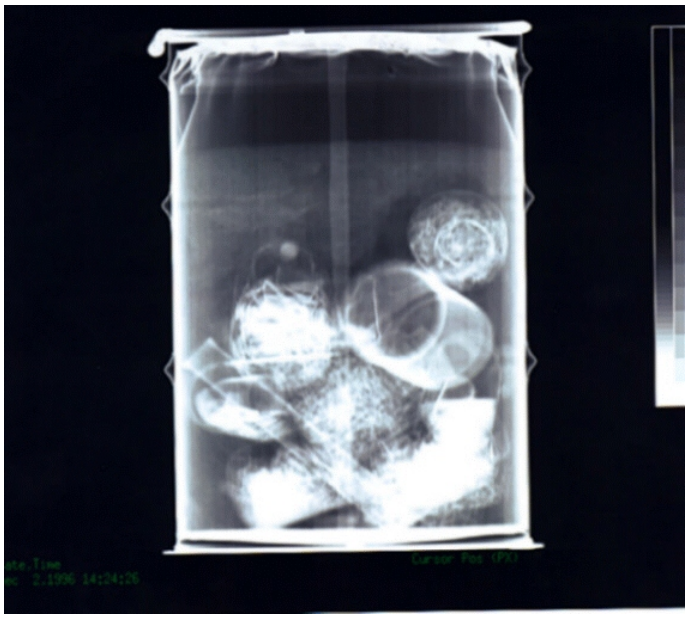

Image of lead lined drum using 2MeV DR/CT system

Non-Destructive Assay (NDA) technologies identify and quantify the radioactivity within a drum. WIT's Active and Passive Computed Tomography (A&PCT) NDA provides radioactive element identifications and accurate total alpha currie quantification of isotopes.

Nondestructive Examination (NDE) is utilized to generate x-ray images of a drum's contents. WIT NDE utilizes Digital Radiography (DR) to provide an entire drum projection, and CT to provide a slice plane and volume x-ray imaging of drum contents.

Benefits:

The baseline technology for NDA is the Segmented Gamma Survey (SGS) and the baseline technology for NDE is Real-Time Radiography (RTR). Invasive techniques, such as visual inspection, must be utilized if proper characterization can not be accomplished with non-invasive technologies. WIT's NDE and NDA capabilities provides significant advantages over the baseline methods. These advantages include:

- WIT's 2MeV (million-volt) DR/CT system is the only technology available for NDE of highly-dense contents such as sludge (such drums account for over half the inventory of drums at some DOE sites).

- WIT's ability to inspect dense contents minimizes the need for invasive inspection techniques.

- WIT is capable of identifying free-liquids, that

baseline NDE techniques can not identify.

▸WIT has demonstrated the ability to inspect lead-lined, steel-pipe, overpacked, drums.

▸More accurate than the baseline SGS, WIT NDA is an absolute measurement and does not require calibration or prior knowledge of drum content.

▸WIT can NDA a variety of TRU-waste drum matrices, including low-density matrices like combustibles and high-density sludge.

▸WIT's Minimum Detectable Concentration (MDC) is below the National TRU Program requirement of 60 nannocuries/gram to allow segregation of low-level waste from TRU waste.

Status and Accomplishments:

▸In 1997, WIT performed NDE/NDA on more than 50 drums at the Idaho National Engineering and Environmental Laboratory (INEEL), including 8 drums for performance verification under the Rapid Commercialization Initiative (RCI).

▸WIT was deployed at the Nevada Test Site (NTS) in August 1998.

▸BIR demonstrated WIT's multi-detector system for NDA at Lawrence Livermore National Laboratory (LLNL) during March & April 1999.

▸WIT has passed several DOE-sponsored blind tests, including the Performance Demonstration Program (PDP), and the Capability Evaluation Program (CEP).

▸The RCI Program has issued a technology verification statement for WIT.

▸In March, 2001, WIT successfully inspected 20 drums using DR/CT to provide evidence to the New Mexico Department of Environmental Protection that the technology can replace visual inspection in meeting the states RCRA permit requirements for the Waste Isolation Pilot Plant (WIPP).

▸BIR is currently under contract with Westinghouse TRU Solutions, LLC, the management and operations contractor for DOE's Carlsbad Field Office WIPP to provide mobile drum inspection services to the DOE.

▸BIR began characterizing four hundred 55-gallon drums contain radioactive waste at Argonne National Laboratory in December 2001. After characterization the drums will be sent to the DOE WIPP permanent underground storage facility at Carlsbad, New Mexico.

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Online Resources:

Office of Science and Technology, Technology Management System (TMS), Tech ID # 259
http://ost.em.doe.gov/tms

The National Energy Technology Laboratory Internet address is http://www.netl.doe.gov

For more information, please visit BIR's website at http://www.bio-imaging.com/

An Innovative Technology Summary Report (ITSR) for the WIT technology may be viewed at: http://apps.em.doe.gov/ost/pubs/itsrs/itsr259.pdf